

Net Shape Molding of Monolithic Complex-shaped Damage-Tolerant Cryo-Insulators, Phase I

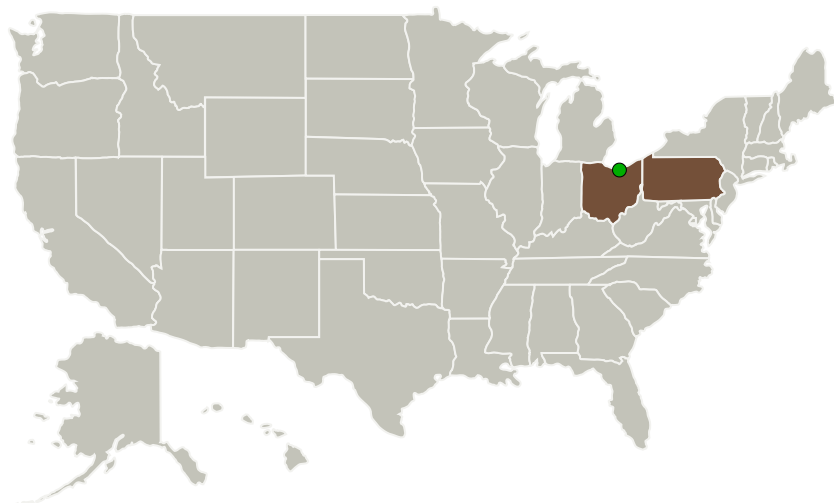
Completed Technology Project (2013 - 2013)



Project Introduction

Passive thermal control of cryogenic systems using foam insulations can help achieve Zero Boil-Off (ZBO). There is as much thermal energy transferred to Cryo tanks during the ascent phase as there is during 6 days of orbital operations using MLIs. Spray on Foam Insulation (SOFI) still suffers from drawbacks both at chemistry and interfacial (bonding) levels. Currently, strong lightweight polymeric foam insulators cannot be (net shape) molded into larger complex shapes, using commercial foaming practices. The proposed Phase 1 research studies feasibility of an inventive (unprecedented) combination of processing and "green" foaming agents to "net-shape" mold low density robust (damage/MMOD tolerant) polymeric insulation foams into "monolithic" complex shapes (such as spherical or cylindrical shells, valve fittings). These can protect polymer matrix composite (PMC) tanks (such as COPVs) against external damages, hence enabling reliable, reusable cryogenic storage designs. An added advantage of this invention is the "clean" decomposition of the blowing agent and development of an environmentally "green" insulative "net-shape" foaming technology.

Primary U.S. Work Locations and Key Partners



	Commercial Rigid Foam Cryo Insulator	Phase 1 Technology Product
Density	1.2X	X
Tensile Strength	Y	1.5Y
Thermal Conductivity	Z	0.9Z
Materials Cost, 1" foam shell, 12" spherical mold	6 Units/lb.	1 Unit/lb.
Manufacturing	Multi-stage, Bonded sheets or profile-cut	Automated net-shape monolithic molding

X, Y and Z represent each row's reference point. Numerics listed in Table 1 of proposal

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Organizations Performing Work	Role	Type	Location
Applied Analytic Research	Lead Organization	Industry	West Chester, Pennsylvania
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Ohio	Pennsylvania
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Project Transitions

May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138348>)

Images

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Project Image

Net Shape Molding of Monolithic Complex-shaped Damage-Tolerant Cryo-Insulators
(<https://techport.nasa.gov/image/136407>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Applied Analytic Research

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

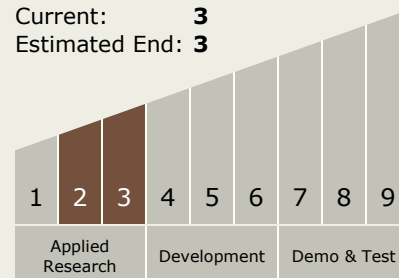
Carlos Torrez

Principal Investigator:

Ray R Armat

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.2 Launch Vehicle Propellant

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System